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ABSTRACT

This project was concerned with the topic of elaborative activity and learning efficiency. "Elaboration" is regarded as an hypothetical process, internal to the learner, which consists of conceiving an event that can serve as a common semantic referent for elements that are initially disparate. The objective of the project was to examine the effects of external learning conditions on the activation of the elaboration process. Such conditions were referred to as "elaborative prompts." Within the project, five major components were distinguished--Verbal Aspects of Elaborative Prompts, Pictorial Aspects of Elaborative Prompts, Verbal and Pictorial Comparisons, Developmental Differences in Verbal and Pictorial Effects, and the Generality of Prompt Effects. (Author)

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Title: **Elaborative Facilitation and Learning in Children**

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The project was concerned with the topic of elaborative activity and learning efficiency. Elaboration is regarded as an hypothetical process, internal to the learner, that consists of conceiving an event that can serve as a common semantic referent for elements that are initially disparate. The objective of the project was to examine the effects of external learning conditions on the activation of the elaboration process. Such conditions are referred to as elaborative prompts. Within the project, five major components may be distinguished: Verbal Aspects of Elaborative Prompts; Pictorial Aspects of Elaborative Prompts; Verbal and Pictorial Comparisons; Developmental Differences in Verbal and Pictorial Effects; and the Generality of Prompt Effects.

Summary of Progress

Progress has been made toward the objectives of the research program in each of its component topics, all of which concern factors associated with the relationship between elaborative activity and learning efficiency. It has been determined that sentence contexts facilitate the associative, not the response-learning phase of noun-pair tasks, whereas pictorial representation of noun pairs facilitates both phases. The relative efficacy of verbal (sentence context) and pictorial (conjoined pictures) prompts to elaborative activity in second-grade children has been shown to vary with conditions of testing (recall vs. recognition, pacing rate). Nevertheless, the relative potency of verbal and pictorial elaborative prompts across the ages four, five, and seven years appears constant. In older samples (sixth-, eighth- and eleventh-graders) a marked interaction of verbally prompted and control conditions with age was detected. This study yielded another unique result, namely, a significant populations effect in noun-pair learning favoring high-SES white over low-SES black subjects. Two other studies, sampling third- and fourth-graders, revealed no such effect. Finally, experiments indicated that generalizations developed from research on noun pair learning can, with qualifications, be extrapolated profitably to other tasks, free-recall learning and text comprehension.

Detailed Report of Results

Verbal Aspects. Two experiments were conducted to further explicate the effects of sentence context on noun-pair learning in children (Lynch and Rohwer, 1971). The problem was to locate the context effect with respect to the two paired-associate sub-processes distinguished by Underwood, Runquist and Shulz (1959): response learning and associative learning. Consistent with much of the previous work on context effects, the subjects in both experiments were sixth-grade children.

In the first experiment, all subjects were asked to learn a list of 20 noun pairs. The experimental conditions formed a two-way design wherein the noun pairs were presented as either printed words or as pictures (line drawings of the referents of the nouns) and, as each pair was displayed, the experimenter uttered either the two nouns or a sentence containing the two nouns. During the pairing trial, the pairs were presented at a 4-sec. rate. At the end of this trial, subjects were asked to recall, in writing, all of the response (i.e., second noun) members of the pairs. At the end of the 2-min. period allowed, the stimulus and response members of all pairs were presented in a random order and subjects were directed to match the members into the original pairs. The order of performing the two tasks, recall (response learning) and matching (associative learning), was counterbalanced within each of the four independent groups.

The results revealed a significant effect of sentence context for both words and picture materials on the matching task but not on the response recall task. Accordingly, it was concluded that sentence context facilitates the associative sub-process in paired-associate learning rather than the response learning process. With regard to the word-picture contrast, the results showed that pictures affected both matching and recall performance, but only when presented with a sentence context. This outcome was deemed inconclusive, however, since the presentation and response modes for the recall task were congruent for the word conditions but not for the picture conditions. Thus, to clarify the result, a second experiment was conducted.

The second experiment also used a noun-pair learning task and the same two-way design. It differed from the first in that only 15 pairs formed the list as well as in the manner of indexing response and associative learning. After the pairing trial, subjects were presented with a sheet displaying all stimuli and responses from the pairing trial along with 10 distractors. Subjects were asked to indicate all items previously seen and to match them into the original pairs.

With regard to the effects of sentence context, the results replicated those of the first experiment; context facilitated performance on the matching task but not on the identification task. Pictures, however, were shown to facilitate performance on both tasks, implying that they affect both of the sub-process in paired-associate learning. These results are consistent with the working conception adopted here about the processes involved in the noun-pair task. Sentence contexts are regarded as direct prompts to elaborative events that can serve as common referents for each of the noun pairs. Accordingly, it would be expected that the effect of sentence context would emerge on the measure most sensitive to the success of the relational part of the process, namely, the associative matching measure. The results also suggest, at least for the age group sampled, that pictures also serve the function of an elaborative prompt, but less directly than in the case of sentence contexts.

Given that the effect of sentence context is to prompt elaboration of a common referent for initially disparate noun pairs, the next question of interest is how sentences provide subjects with improved access to the stored response nouns when given the stimulus nouns as cues.

Another means of attacking this question is to ask it in terms of a task other than noun pair learning, namely, the task of free recall learning. Extrapolating from the sentence effect, it might be hypothesized that if a sentence aids the retrieval of noun pairs, a set of related sentences might aid the retrieval of several nouns. If so, the free recall paradigm would be useful since it permits an assessment of the retrieval function of context through the manipulation of cues during recall trials.

An experimental exploration of this possibility has now been completed (Gerdes, 1971). Seventh-grade children were asked to learn a list of 36 nouns drawn in equal numbers from each of six semantic categories (animals, foods, utensils, etc.) The items were presented in random order such that every category was represented in successive six items sets. Two conditions of presentation were used. In one, the category membership of each item was emphasized by presenting the category name in conjunction with the item. This was accomplished as follows: after each set of six items was presented, the experimenter uttered every item again along with the name of the category it represented (e.g., "fox, animal"). In the other condition, the story condition, the experimenter filled the inter-set interval by uttering a story containing the six items in the set. Within each of these conditions, two conditions of recall were used: cued, where either the category names or the story titles were provided by the experimenter; and control, where neither kind of cue was provided. Thus the study manipulated the saliency of two kinds of cues, category and story, at either the time of presentation, or at both presentation and retrieval.

With respect to category cueing, significant effects were observed at both loci; relative to the control condition, cueing at presentation improved recall, and a substantial additional increment was provided by the addition of cueing during the test trial. A similar outcome was revealed in the case of story cueing, although the superiority of cueing at both presentation and retrieval was even more pronounced than in the case of category cueing. These results are consistent with the hypothesis that elaborative prompts are important for the retrieval of information as well as for its storage.

Pictorial Aspects and Verbal-Pictorial Comparisons. In the Lynch and Rohwer (1971) study previously described, an application of the associative-response-learning distinction revealed an effect of pictures on both processes whereas sentence context appeared to affect only the associative component. This result suggests the application of a similar methodology in a design that includes the manipulation of inter-noun aspects of pictures such as conjoining. If conjoining elicits an elaborative process similar to that elicited by sentence contexts, its effects should also be confined to the associative component. An experiment designed for this purpose will be proposed shortly.

Another completed study concerned pictorial manipulations (Kee and Rohwer, 1970). The design of the study included conditions replicating those used by Davidson and Adams (1970), namely, depiction (conjoined vs. separated pictures) and verbal context (conjunction vs. preposition connectives for the noun pairs). The subjects were 120 second-grade children randomly assigned in equal numbers to each of the 12 conditions that constituted the design. The factor of response condition (recall-short, recall-long, recognition) was crossed with

the other two factors of depiction and verbalization. The purpose of the study was to ascertain whether these differences in the conditions of responding account for differences in the magnitude of facilitation produced by verbal context and pictorial conjoining.

All subjects were instructed to learn a list of 20 noun pairs presented pictorially at a 4-sec. rate. During the test trials, the stimulus members of each pair were presented at an 8-sec. rate in the recall-long and recognition conditions and at a 4-sec. rate in the recall-short condition. In the recall conditions, subjects responded orally; in the recognition condition, they pointed to one of the twenty pictures of response items displayed on a single page before them as each stimulus member was displayed.

In agreement with previous research, the results revealed large positive effects for conjoined pictures and for preposition connectives in all response conditions. Consistent with the outcome reported by Davidson and Adams, the effects of preposition connectives in the recognition condition were relatively larger than those of conjoining. In recall, however, the order of effects was reversed, with conjoining appearing the more powerful manipulation. This apparent interaction suggests the possibility that conjoining, unlike verbal context, affects both response learning and associative learning rather than associative learning alone. Finally, the magnitude of facilitation produced by the depiction and verbalization manipulations taken together did indeed vary as a function of response conditions; facilitation was greater in recognition than in either of the recall conditions.

In addition to an analysis of the component processes affected by the conjoining manipulation, the topic of pictorial aspects is in need of two other kinds of analysis. The first concerns the question of how conjoining aids subjects in retrieving pair members. As was suggested in connection with sentence context effects, an obvious approach is that of manipulating test trial cues. The second kind of analysis pertains to the elaborative prompting properties of conjoining itself. Virtually nothing is known about those features of conjoined configuations that control the magnitude of its effects on learning efficiency.

Developmental Differences. Three experiments will be described pertaining to questions of developmental differences in the domain of elaborative activity. The first concerns issues raised by Paivio (1970), Reese (1970) and Rohwer (1970) as to developmental trends in the age range four to seven years, specifically, those regarding comparisons of verbal and pictorial manipulations. In previous research (see Rohwer, 1970 , for a review) the typical outcome was that pictorial manipulations (word vs. picture presentation; conjoined pictures vs. verbal context) increased in potency, relative to verbal ones, as a function of age. The present study was designed to determine whether or not these developmental phenomena are attributable to the child's increasing facility at decoding stored information as he grows older. Accordingly the method used was to contrast the effect of response conditions (recall vs. recognition) on performance in a variety of experimental conditions for samples of four, five and seven-year old children. The recognition procedure was assumed to minimize the incongruence between presentation mode (pictures) and response mode (oral) that characterizes the recall procedure.

All subjects were asked to learn a list of 20 noun pairs presented in accord with a pairing-test method for a total of two complete trials. The pacing rate was 4-sec. on pairing trials and 6-sec. on test trials. In the recognition conditions, as each stimulus member of a pair was displayed, the subject was asked to point to the correct response member on a sheet containing pictures of ten of the response terms in the list. In recall, subjects were simply asked to respond by uttering the second noun of the pair in question.

Two aims guided the selection of conditions to be included in the experiment. The first was to replicate previous findings with respect to (a) the manner in which pair members were presented (separated pictures vs. spoken nouns) and (b) the manner in which the synthesis of pair members was encouraged (conjoined pictures vs. preposition connectives). In order properly to evaluate these contrasts the conditions selected were those displayed in the two designs, Panel A and Panel B, of Table 1. The first design, Panel A, permits an evaluation of the replicability of the observations that the relative superiority of picture to noun presentation increases with age and that the relative superiority of combined presentation (picture + noun) over picture presentation decreases with age. The design in Panel B permits an evaluation of the parallel hypothesis for the manner in which pair members were synthesized in the presentation method. The two additional conditions (nouns with prepositions, and conjoined pictures without nouns) displayed in Panel C were included to permit, in conjunction with the other two conditions (nouns alone and separated pictures alone), an appraisal of the developmental hypothesis concerning synthetic properties when modality is pure, that is, entirely aural or entirely pictorial.

Unfortunately, we were unable to develop a recognition procedure for aurally presented material that was within the capability of the young children sampled. Accordingly, the recognition condition was used only for conditions in which the materials were pictorial. Thus, only the second design was completely replicated under both response conditions (Panels B and D).

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The total sample consisted of 504 white children from high-SES backgrounds, chosen in equal numbers from groups of four-, five-, and seven-year olds. Within each age level, subjects were randomly assigned to the various cells of the design so that the within-cell sample size was 12.

The results are displayed in Table 1. As an inspection of the results obtained for Designs A and B indicates, analysis of variance confirmed that the phenomena under investigation were not replicated in the present study. Neither the contrast between pictures and nouns nor that between conjoined pictures and preposition connectives differed significantly as a function of age. Furthermore, the pattern of conditions effects was quite similar in recall and recognition (cf. Designs B and D). Statistical analysis did reveal a consistent trend such that conditions designed to evoke elaborative activity (conjoined pictures and preposition connectives) produced larger effects as a function of increasing age.

Table 1

Mean numbers of correct responses per trial as a function of age and conditions for the several designs

Design A (Recall)

	Conditions		
Age	N	S	N+S
4	2.9	2.9	4.2
5	2.4	3.8	4.3
7	2.5	3.4	4.8

Design B (Recall)

	Conditions			
	N+S	N+C	Pr+S	Pr+C
4	4.2	11.8	8.8	11.4
5	4.3	11.6	9.1	11.3
7	4.8	11.5	11.0	13.4

Design C (Recall)

	Conditions			
Age	N	Pr	S	C
4	2.9	6.0	2.9	7.3
5	2.4	6.6	3.8	10.3
7	2.5	7.4	3.4	10.7

Design D (Recognition)

	Conditions			
	N+S	N+C	Pr+S	Pr+C
4	4.8	11.1	8.9	11.5
5	6.5	12.9	12.1	13.6
7	5.4	12.8	12.1	15.5

Other (Recognition)

	Conditions	
Age	S	C
4	4.5	8.4
5	4.7	10.3
7	8.1	13.4

N: Nouns
Pr: Preposition Connectives
S: Separated Pictures
C: Conjoined Pictures

(From Kee, Guy & Rohwer, 1971.)

Interestingly enough, the outcome yielded by an analysis of the data displayed in Design C was as predicted: the benefit derived from conjoined pictures (relative to separated pictures) increased more as a function of age than the benefit derived from preposition connectives (relative to aurally presented nouns). Since these pairs of conditions also differed with respect to the manner in which the nouns themselves were represented (words vs. pictures), however, the import of the result is as yet undetermined.

A permissable conclusion from the results of this study is that the age by modality interaction observed and interpreted previously (Paivio, 1970; Reese, 1970 ; Rohwer, 1970) is either an artifact of unknown variables or is weak and therefore unreliable.

The second experiment concerned with developmental differences produced results that are more promising for further research and analysis. This experiment was designed to answer two questions: (a) at what age do children begin to engage in relatively unprompted elaborative activity during noun-pair learning; and (b) which of two means for prompting elaborative activity, presented sentence contexts or sentence instructions, is more effective in promoting efficient learning? The design for the study included four conditions--control, rehearsal, presented sentence, and generated sentence. These conditions were replicated with five different age levels defined as first-, third-, sixth-, eighth-, and eleventh grades. For generality, the entire experiment was conducted in two different populations: high-SES white and low-SES white.

Within each population and grade level, the sample of 40 subjects was randomly assigned in equal numbers to each of the four conditions. All subjects were asked to learn 36 pairs of familiar nouns by a pairing-test method in which two trials of each kind were given alternately. The pacing rate on the first pairing trial was 15-sec. and the rate for the second pairing trial and for both test trials was 4-sec. Instructions varied from condition to condition. In the second condition they simply asked subjects to remember the noun pairs; in the rehearsal condition subjects were asked to repeat each noun pair aloud, as frequently as possible during the interitem intervals of the first pairing trial; the presented sentence condition asked subjects to listen to and repeat each sentence (one per noun pair) during the interitem intervals; and subjects in the generated sentence condition were asked to construct, utter and repeat a sentence for each noun pair during the interitem interval.

These four conditions were selected in accord with the following rationale. Rehearsal was regarded as a baseline condition in the sense that the subject's pairing trial activity was externalized and consisted of repeated presentations of each pair, that is, his activity, whatever its effect on learning efficiency, was simple and observable. The control condition was specifically chosen to give free reign to the subject's propensities for engaging in self-selected activity. If this activity consisted of rehearsal, his performance should be equivalent to that in the rehearsal condition; if it was elaborative activity, his performance should approximate that in the sentence conditions. Thus, the presented-sentence condition was included to permit comparative conclusions about the degree of functional equivalence between subject-prompted activity, in the control condition, and the kind of learning efficiency observed when elaborative activity is more

directly prompted by sentence contexts. The generated-sentence condition provided for comparisons with the effects of presented-sentence contexts. From a developmental viewpoint, this comparison was of empirical interest since Bobrow and Bower (1969) and Bower and Winzenz (1970) found that generated sentences were associated with greater learning efficiency in college students than presented sentences. The contrast is of theoretical interest as well: it pits two elaborative prompting conditions that differ prominently in the sense that one, presented-sentence, directly provides for each pair of nouns, an event that can serve as their common referent, whereas the other condition, generated sentence, explicitly asks the subject to find such events himself. The conditions are similar in that the subject's overt activity in both consists of uttering aloud sentences containing the two nouns in every pair.

The results, measured in terms of average percentage of correct responses on the two test trials are presented in Figure 1. Analysis of variance confirmed the picture displayed in the two charts. In virtually all of the low-SES samples, performance in the rehearsal and control conditions was indistinguishable and in all cases the two sentence conditions produced substantially higher degrees of learning efficiency. The sentence conditions manipulation, itself, accounted for almost none of the variance.

For grades one, three, and six, the pattern of results for the high-SES samples was very similar to that for the low-SES samples: equivalence of control and rehearsal conditions, equivalence of the two sentence conditions and substantial superiority of the sentence conditions over control and rehearsal. For the eighth- and eleventh-grade samples, however, performance in the control condition was increasingly better than in the rehearsal, so much better in the eleventh grade samples that it exceeded performance in the sentence conditions.

Comment on the population effect will be reserved for the next section. The results for the high-SES samples are most intriguing. They suggest that the emergence of unprompted elaborative activity begins to become evident between the ages of eleven and fourteen and that it is sufficiently functional by age seventeen to surpass the effect of whatever activity is prompted by the two kinds of sentence conditions imposed. With regard to previous findings, those of the present experiment are partially confirmatory, that is, they show that presented sentences are not particularly effective at facilitating learning in older subjects (here eleventh graders, in Bobrow and Bower, 1969, college students). The present results, however, do not confirm the superiority of the generated sentence treatment.

Generality of Prompt Effects. As noted, the design just described revealed not only interesting interactions of age with conditions in the high-SES sample but a different pattern of effects, especially those associated with the control condition, for the low-SES sample. It was decided to expand the population sampling for the experiment by adding sixth-, and eighth-grade groups from a low-SES black population. The low-SES black and white samples were in no sense matched in terms of SES. The black children came from neighborhoods in which parents' educational level and other census data on features of residence was clearly lower than for the white neighborhoods. Thus, attempts to attribute the results to ethnicity are quite unwarranted. The important consideration here is the question of generality of effects from population to population.

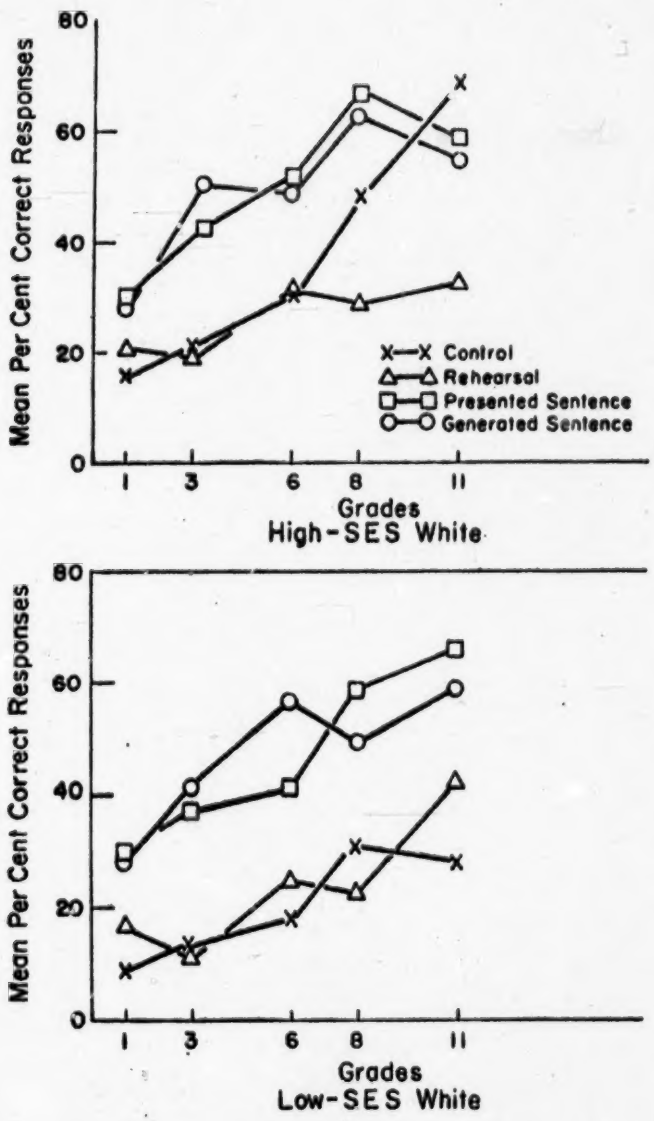

Figure 1. Mean percent responses correct as a function of conditions and grades (upper panel: high-SES white; lower panel: low-SES white).

The results for the three populations in each of the four conditions are shown in Figure 2. Analysis of variance revealed that the conditions effects previously described for the low-SES white sample also emerged for the low-SES black sample. Summing across conditions both pairwise comparisons among the three populations were significant. This summary, however, must be qualified to take into account two facts: (a) the populations effect was more pronounced for the eighth than for the sixth-grade samples; and (b) this was clearest in the case of the control and generated sentence conditions--in the rehearsal condition, the effect was not significant at the eighth-grade level.

Research is now needed to follow up on several features of these results. The first order of business is to determine whether or not they are replicable, especially with regard to the interaction of control and rehearsal conditions as a function of age. Second, it is puzzling that this study is alone among those reviewed herein revealing a population effect in noun-pair learning. It differs in two ways from other studies using this task with these two populations: the materials were presented aurally rather than pictorially; and, the age levels sampled were older.

Another study pertaining to population effects in noun pair learning was conducted by Green (Green & Rohwer, 1971). The study was designed simply to ascertain whether or not significant variance in performance on three tasks is associated with the classification variable of SES in fourth-grade black children. The three tasks were: Raven Coloured Progressive Matrices, a digit-span test of immediate memory, and a paired-associate test. The digit-span task consisted of seven series, ranging in length from three to nine. The paired-associate task involved learning a list of 20 noun pairs by a pairing-test method. The pacing rate for each of the two alternating pairing and test trials was 5-sec. All the nouns were represented by pictures of their object referents.

The total sample consisted of 60 fourth-grade children divided into three groups of equal size varying in terms of standing on the Warner Index of Status Characteristics. In addition to the SES ratings, information on each of the following variables was available for all subjects prior to the study: reading grades, math grades, score on the SAT test of reading, and score on the Lorge-Thorndike IQ test. In each case the descending order of means for the three groups was: middle-SES, lower-middle SES, low-SES.

The results showed that significant proportions of variance were associated with SES differences for the Raven (ω^2=.15) and the digit-span task (ω^2=.32) but not for the paired-associate task (ω^2=.00+). This outcome once again confirms previous findings that population effects are not discernible on a paired-associate task at this age level; the study adds to the generality of this result insofar as it sampled entirely within a black population, holding ethnicity constant, while varying SES.

In another study just completed, the main purpose was to assess the comparability of results across two kinds of designs: mixed-list and independent groups. Two populations (high-SES white and low-SES black) were sampled, however, since they had provided the original samples in the investigation the present one was designed to explicate (Rohwer, Ammon,

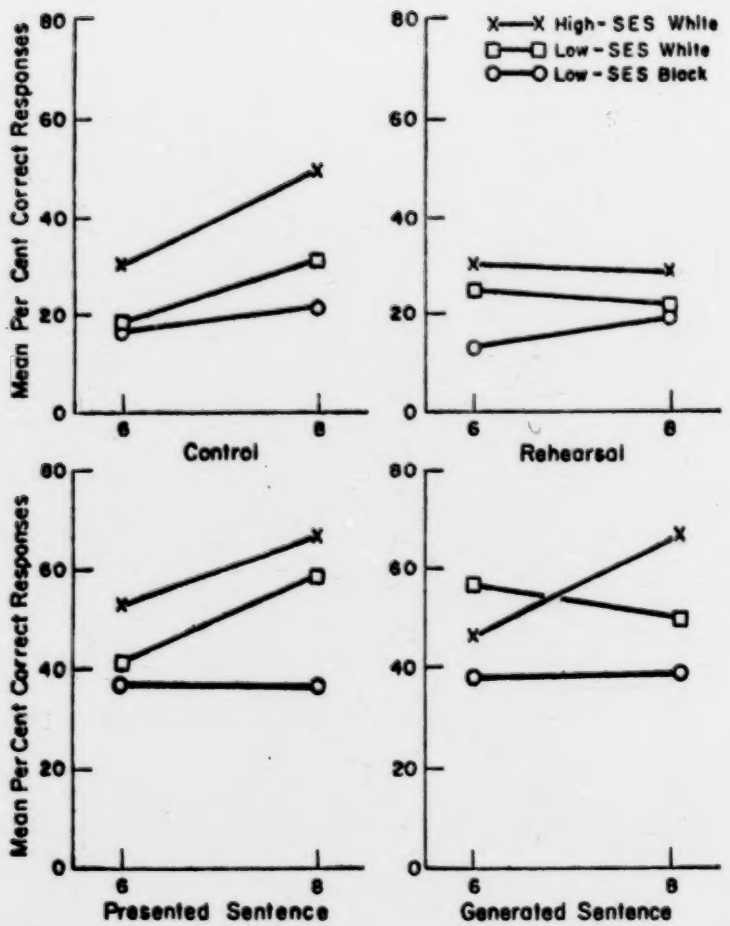

Figure 2. Mean percent responses correct as a function of conditions, grades, and populations.

Suzuki & Levin, 1971). In the original study, children were asked to learn 25-item lists of noun pairs by a pairing-test method. In each list, the pairs were presented in five different ways: aurally presented nouns, pictures of object referents, nouns and pictures, sentence context and pictures, nouns and episodic pictures. The results for third-grade children from both populations showed that all pairwise differences between these presentation conditions were significant, with nouns-episodic pictures producing the highest degree of learning efficiency.

Since a mixed-list, or within-subjects, design such as this is substantially less costly to complete than an independent groups design, it was decided to ascertain the reliability of the conditions effect by replicating the study with a design in which every condition was also represented by a pure list, that is, by an independent group. The study was conducted with samples of equal numbers of children drawn from high-SES white and low-SES black third-grade populations. The results were quite encouraging. The pattern of effects observed in the independent groups design was substantially the same as that observed in the mixed-list design, both with respect to conditions and with respect to population effects.

Given the apparent reliability of the mixed-list design, it was applied in an additional study of the generality of elaborative prompt effects across four populations of second-grade children: white, chinese, mexican-american, and black. Each child in the total sample of 160 was administered two lists of 25 noun pairs by a pairing test method. For half of each sample, the response mode was recognition and for the other half it was recall. Five conditions of presentation were each represented by five items in each list: separated pictures; separated pictures + nouns; separated pictures + prepositions; conjoined pictures + nouns; and conjoined pictures + prepositions. Only a preliminary analysis of the results has been completed. Thus far, they reveal the typical pattern of effects such that those conditions providing more explicit elaborative prompts are associated with more correct responses than pictures alone or pictures with nouns. Furthermore, the pattern of effects appears to be general across all four populations and both modes of response. Once more, in the elementary school age range, performance levels are equivalent across a wide range of populations.

The next study to be described (Irwin, Gerdes & Rohwer, 1971) represents a departure from previous ones in that the task was free recall rather than paired-associate learning. The principal aim of the study was to determine whether or not instructions to create verbal contexts would increase learning efficiency in free recall as they do in paired-associate learning. Once again, two populations (high-SES white and low-SES black) and two age levels (kindergarten and fifth grade) were sampled to permit an assessment of the generality of the experimental effects observed.

All subjects were asked to learn a list of 25 familiar nouns by a study-test method for a total of three alternating study and test trials. Each noun was presented aurally and represented by a picture of its referent as well. For the fifth-grade samples, the design was a 2 x 3 factorial in which the principal variables were instructions (study vs. story context) and lists

(categorized-blocked, categorized-random, unrelated). In the categorized lists, the nouns were sampled from the domains of foods, parts of the body, kitchen utensils, animals, and vehicles. The items were presented individually at a 4-sec. rate but after every five items, a fifteen sec. interval was interposed. During these intervals, subjects in the context conditions were directed to construct and utter a story containing the five nouns just presented. Subjects in the study condition were simply asked to remember the items presented. After each study trial, subjects were allowed three minutes to respond orally with all of the nouns they could remember, in any order.

Unfortunately, limits on subject availability precluded a complete replication of this design with the kindergarten samples. Thus, the condition involving the presentation of a list of unrelated items was deleted and the conditions formed a 2 x 2 design, which, in other respects was identical to that applied to the fifth-grade samples.

The results for the fifth-grade samples revealed a positive effect of story instructions on all three lists for the high-SES white children but only on the list of unrelated nouns for the low-SES black children. Among kindergarten subjects, the story effect was significant only on the categorized-blocked, not on the categorized-random list. The population effect was not significant for fifth-graders given story instructions on categorized-blocked and unrelated lists. Contrary to previous findings (Glasman, 1968; Jensen & Frederiksen, 1970) the population effect was not significant in any of the three control conditions.

In a closely related study (Gerdes, 1971), a portion of which was described in a previous section, the effect of story prompts was assessed for high-SES white and low-SES black seventh-graders. In this case, however, the story prompts were presented by the experimenter rather than being generated by the subject. Recall that the three treatment conditions used were distinguished by the locus of the story prompt: control, study trial, or both study and test trial. All subjects were asked to learn a 36-item list of categorized nouns presented in random order. As reported earlier, among high-SES white subjects, the effect of the story prompt was associated with more correct responses than were produced in the control condition, especially when story cues were presented on both the study and test trials. Although the effect was not as large, story treatments also facilitated performance in the low-SES black sample. Nevertheless, the generality of the effect was by no means complete -- for the low-SES black subjects, test trial cueing provided no additional benefit over that of study-trial presentation alone.

The reasons for the variation in results among studies using the method of free recall are not yet clear. Further exploration seems called for with respect to prompting conditions, list types, and developmental level, as well as including an assessment of generality across populations.

The final experiment to be described extends some of our previous work with noun-pair learning even further afield than the free-recall study, namely, to the task of text comprehension (Matz & Rohwer, 1971). The study was

prompted by three lines of evidence. The task was adapted from research reported by Frase (1969). In these studies the performance of verifying assertions about information in a passage was shown to vary as a function of the distance, in the original text, between the two items of information comprising the assertion; the larger the distance, in number of intervening sentences, the more difficult the item.

The other two lines of evidence formed an anomaly. In elementary school children, low-SES black samples had been shown to perform at levels as high as those attained by high-SES white subjects on noun-pair learning tasks in which the materials were presented pictorially. On standardized tests of reading comprehension, however, the average performance of the high-SES white samples regularly exceeded that of the low-SES black samples (cf. Rohwer, Ammon, Suzuki & Levin, 1971). Accordingly, the present study was designed to determine whether or not the population effect in comprehension varies as a function of presentation mode (text vs. pictures).

A 2x2x4 design was replicated with two samples of 64 fourth-grade children drawn from a high-SES white and a low-SES black population. All children listened to three passages read aloud. Each passage consisted of two paragraphs pertaining to the same general topic (e.g., two hypothetical species of monkey). After each passage, the subject was asked to verify eight assertions about the material presented. The assertions varied in presumed difficulty across four levels defined by the number of intervening sentences in the original passage (one, two, three, or four). Two of the assertions about each passage represented each level. Thus, assertion level was a within-subject factor.

The independent groups portion of the design consisted of two factors: presentation mode and testing condition. The passages were read aloud to all subjects but for half of each sample, the visual accompaniment to the aural material was a printed text of the passage whereas for the other half of the sample it was a pictorial illustration of the information in the text. Two conditions of testing were used, inspection and memory. In the inspection condition, the visual material pertinent to the passage, whether printed text or pictorial illustration, was completely available during the time that subjects were engaged in verifying the eight assertions; in the memory condition, subjects were not permitted access to either the text or the pictures while verifying the assertions.

The results revealed that performance was virtually invariant across testing conditions, that is, the percentage of correct verifications was equivalent for the memory and inspection conditions. This outcome is puzzling insofar as it suggests an inability on the part of these samples of subjects to benefit from access to all relevant information at the time of testing.

The question of principal interest concerned the predicted interaction of populations and presentation mode. As indicated by an inspection of Table 2, this interaction was indeed significant such that the population effect favoring high-SES white children was virtually eliminated in the pictorial condition. Furthermore the usual effect of assertion difficulty level emerged in all conditions, precluding an attribution of the interaction to a ceiling artifact.

Even though this outcome was predicted, it leaves many questions unanswered. Would the text condition improve performance relative to a solely aural condition? Would other dependent variables reveal consistent results (e.g., free recall of the passages)? Would developmental interactions emerge if sampling included other age levels, especially with regard to the equivalence of the memory and inspection conditions? Fortunately, these questions are open to empirical answers so that future research can provide them.

Table 2

Mean percentage of correct verifications as a function of populations and presentation mode

Mode	Population	
	High-SES White	Low-SES Black
Picture	89.96	80.60
Text	82.02	57.81

References

Bobrow, S. A., & Bower, G. H. Comprehension and recall of sentences. Journal of Experimental Psychology, 1969, 80, 455-461.

Bower, G. H., & Winzenz, D. Comparison of associative learning strategies. Psychonomic Science, 1970, 20, 119-120.

Davidson, R. E., & Adams, J. F. Verbal and imagery processes in children's paired-associate learning. Journal of Experimental Child Psychology, 1970, 9, 429-435.

Frase, L. T. Structural analysis of the knowledge that results from thinking about text. Journal of Educational Psychology Monograph, 1969, 60, No. 6, Part 2.

Gerdes, B. J. The relationship of provided organization to free recall learning in two populations. Unpublished doctoral dissertation, University of Calif., 1971.

Glasman, L. D. A social-class comparison of conceptual processes in children's free recall. Unpublished doctoral dissertation, University of California, 1970.

Green, R. B., & Rohwer, W. D., Jr. SES differences on learning and ability tests in Black children. American Educational Research Journal, 1971, 8, 601-609.

Irwin, A. H., Gerdes, B. J., & Rohwer, W. D., Jr. SES, age, and facilitation of free recall learning. Paper presented at the annual meeting of the American Educational Research Association, New York, 1971.

Jensen, A. R., & Frederiksen, J. Social class differences in free recall of categorized and uncategorized lists. In A. R. Jensen and W. D. Rohwer, Jr. An experimental analysis of learning abilities in culturally disadvantaged children. Final report on U. S. Office of Economic Opportunity Contract Number OEO 2404. July, 1970.

Kee, D. W., & Rohwer, W. D. Jr. Paired-associate learning efficiency as a function of response mode and elaboration. Paper presented at the annual meeting of the American Educational Research Association, Minneapolis, Minnesota, 1970.

Lynch, S., & Rohwer, W. D. Jr. The effects of verbal and pictorial elaborations on associative learning and response learning in a children's PA task. Journal of Educational Psychology, 1971, 62, 339-344.

Matz, R. D., & Rohwer, W. D., Jr. Visual elaboration and comprehension of text. Paper presented at the annual meeting of the American Educational Research Association, New York, 1971.

References (cont.)

Paivio, A. On the functional significance of imagery. Psychological Bulletin, 1970, 73, 385-392.

Reese, H. W. Imagery and contextual meaning. Psychological Bulletin, 1970, 73, 404-414.

Rohwer, W. D., Jr. Images and pictures in children's learning. Psychological Bulletin, 1970, 73, 393-403.

Rohwer, W. D., Jr., Ammon, M. S., Suzuki, N., & Levin, J. R. Populations differences and learning proficiency. Journal of Educational Psychology, 1971, 62, 1-14.

Underwood, B. J., Runquist, W. N., & Shulz, R. W. Response learning in paired-associate lists as a function of intralist similarity. Journal of Experimental Psychology, 1959, 58, 70-78.

Publications and Manuscripts

Frederiksen, J. A., & Rohwer, W. D., Jr. Elaborative prompt effects in children's paired-associate learning: Design and population comparisons. Submitted for publication.

Gerdes, B. J. The relationship of provided organization to free recall learning in two populations. Unpublished doctoral dissertation, University of California, Berkeley, 1970.

Green, R. B., & Rohwer, W. D., Jr. SES differences on learning and ability tests in Black children. American Educational Research Journal, 1971, 8, 601-609.

Irwin, M. H. A developmental study of elaboration modality effects in paired-associate learning. Unpublished doctoral dissertation, University of California, Berkeley, 1971.

Kee, D. W., & Rohwer, W. D., Jr. Noun-pair learning in four ethnic groups: conditions of presentation and response. Submitted for publication.

Lynch, S., & Rohwer, W. D., Jr. The effects of verbal and pictorial elaborations on associative learning and response learning in a children's PA task. Journal of Educational Psychology, 1971, 8, 11-26.

Rohwer, W. D., Jr. Mental elaboration and proficient learning. In J. P. Hill (Ed.) Minnesota Symposia on Child Psychology, Vol. 4. Minneapolis: University of Minnesota Press, 1970.

Rohwer, W. D., Jr. Images and pictures in children's learning: Research results and educational implications. Psychological Bulletin, 1970, 393-403.

Rohwer, W. D., Jr. To find an appropriate question. In J. R. Levin, P. Wolff, R. E. Davidson, & W. D. Rohwer, Jr. Issues in imagery and learning: Four papers. (Theoretical Paper No. 36) Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning, 1972.

Rohwer, W. D., Jr. Elaboration and learning in childhood and adolescence. In H. W. Reese (Ed.) Advances in child development and behavior. Vol. 8. New York: Academic Press, in press.

Rohwer, W. D., Jr., & Bean, J. P. Sentence effects and noun-pair learning: A developmental interaction during adolescence. Journal of Experimental Child Psychology, in press.

In addition to the reports listed in the immediately preceding section, manuscripts describing the remaining studies completed in the project are now in preparation. In due course, these manuscripts will be submitted for publication in appropriate journals, including Journal of Educational Psychology, Journal of Experimental Child Psychology.